THE MODEL ENGINEER

Vol. 86 No. 2129

Percival Marshall & Co., Limited
Cordwallis Works, Maidenhead

February 26th, 1942

Smoke Rings

Models in Literature

I QUOTED a few weeks ago an interesting reference to models in Tennyson's poem "The Princess," and enquired if any reader could discover earlier references to our hobby in other published works. No one has yet quoted anything from Shakespeare, and whether such a quotation is at all possible, I do not know. But another old friend, Mr. W. Dendy, has kindly sent me a copy of Lord Lytton's book, famous in its day, "The Last of the Barons." This book, written in 1843, is an historical romance dealing with the period of the late fifteenth century. One of the characters is an inventor, Adam Warner by name, who has constructed a machine called the "Eureka," designed to solve the problem of the production of gold, a subject which in those days was the absorbing interest of philosophers and alchemists. Adam Warner felt it necessary to incorporate in his machine an engine which would develop power such as would "turn a mill without wind or water, or set in motion some mimic vehicle without other force than that the contrivance itself supplied." He had spent twenty-five years on the perfection of his invention and was commanded to demonstrate his working model before King Henry and the Duke of Gloucester. It was a fearsome and wonderful thing, according to the story, with many doors and compartments through which a lump of brass was to pass in the course of its conversion into gold. The inventor, however, desired that his machine should do something more than this, and demonstrate the power of steam to accomplish tasks hitherto performed by hand. The story says :—"It is true that it was crowded with unnecessary cylinders, slides, cocks, and wheels—hideous and clumsy to the eye—but through this intricacy the great simple design accomplished its main object." In fact, it worked, to the amazement of the King and his attendants. But in constructing his steam plant, Adam Warner had overlooked one essential detail, the provision of a safety-valve on his boiler, and, to his dismay and to the consternation of the assembly, the model boiler burst. The spectators were certain that the model was intended to bring about their destruction, and with the exception of the Duke, who, we are informed, remained unmovable and still frowning, they rushed headlong for the door. The unfortunate inventor was in immediate disgrace, but for news of the subsequent future of the model and its builder I must refer my readers to the book itself. It must, of course, be remembered that this story is a romance, and does not provide any historical record of such a model having actually been made at that period. At the time of writing the book Lord Lytton must have been well aware of the steam engines of Newcomen and James Watt, and it was purely an ingenious fancy on his part to introduce such a contrivance as Adam Warner's model into his story.

. . . ——

The London Forces Exhibition

I AM now able to state that the exhibition of handicraft work of members of the Forces stationed in the London district, will be held at the National Portrait Gallery, Trafalgar Square, from March 9th onwards, to the 31st. A large number of interesting models have already been entered, and an influential committee has been formed to ensure that the exhibits will be effectively arranged. Some attractive posters advertising the exhibition are being prepared, and the organisers would be glad of any assistance in ensuring that they are well displayed in suitable positions. The private view day and official opening will be on Monday, March 9th, and the exhibition will be open to the public on March 10th and subsequent days from 10 a.m. till 6.30 p.m. Any enquiries should be addressed to the Organiser, London District Forces Exhibition, Donington House, Norfolk Street, London, W.C.2.

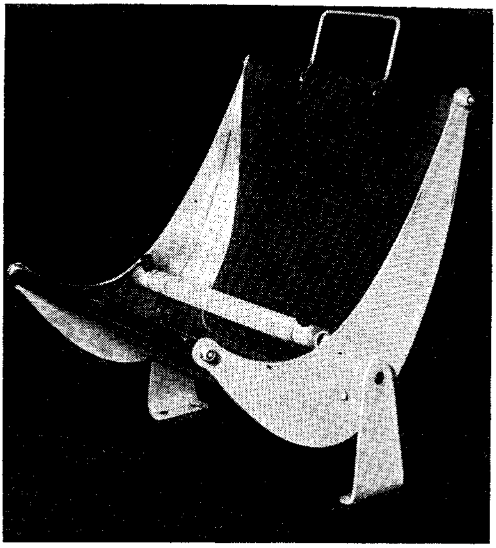
Percival Marshall

An ELECTRIC FIRE for the Workshop

By L. POWELL

FEELING the need for some form of heating in my workshop decided me to make up the electric fire about to be described. I had sometime previously bought a 750-watt. fire element from one of the popular chain stores, for the modest sum of half-a-crown, so I designed the fire of the reflector type to use this element.

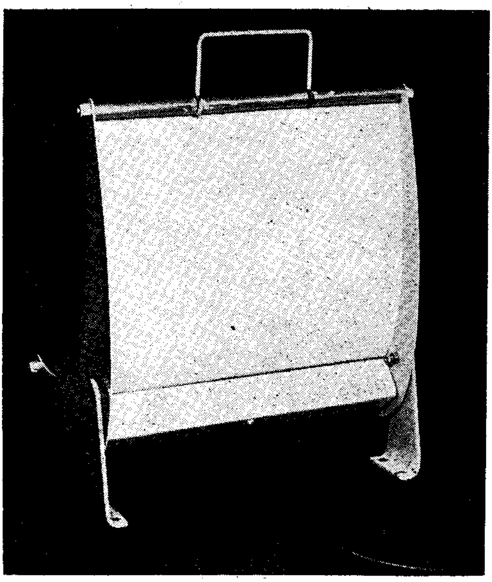
The reproduced drawings show dimensions of the various parts, but some slight modification may be necessary to suit different types of elements.



A view of the fire standing on the floor.

Side Plates (1)

These are cut from any available material of about 16 s.w.g. to the shape indicated. Mark out one plate, drill the holes and use these to clamp the two pieces of material for cutting out. I cut mine on the fretsaw machine, using an "Eclipse" junior blade reduced in width, the edges being finally cleaned up with a smooth file.



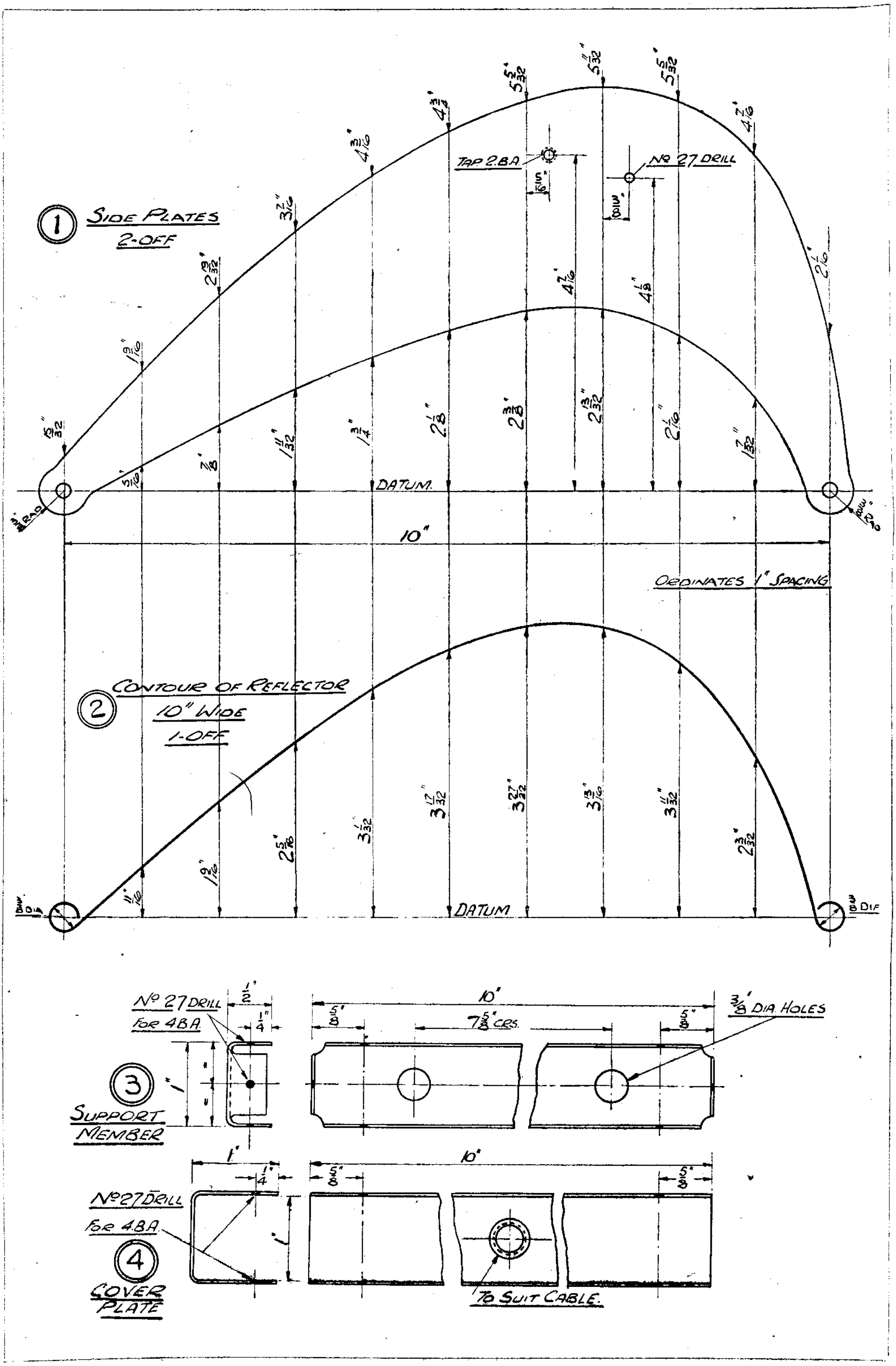
As seen from the back.

Reflector (2)

This is made from aluminium sheet of about 20 s.w.g. At the present time this will be unobtainable new, but a visit to the local car breakers should enable one to buy an old car door that has been panelled in aluminium. Cut a piece $15\frac{1}{2}$ in. $\times$ 10 in., and select the best side and give it a good polishing on the buff until it is quite bright. Now roll the two ends round a piece of $\frac{3}{8}$ in. diameter rod, removing the rods when formed. The method I used to bend the plate to the correct contour was to grip in the vice a piece of wood somewhat longer than the plate, with the top edge radiused, and draw the plate backwards and forwards over this, gradually forming the contour, which is checked from a template cut to the shape indicated. When the finished shape is reached the only other work on this part is to cut slots in the top edge for the handle and two $\frac{3}{4}$ in. diameter holes to allow the supports for the element to pass through; these can be positioned from the mating parts.

Support for the Element (3)

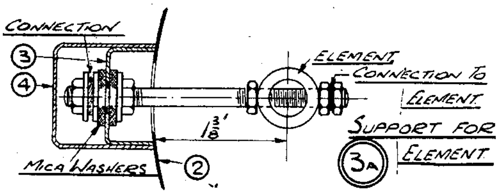
This may be made up from any available material of about 20 or 22 s.w.g., bent and drilled to the shape shown. The supports for the element are 3/16 in. diameter brass or steel rod, screwed 2 B.A. or 3/16 in. Whit. The holes for these in the member are $\frac{3}{8}$ in.


1 SIDE PLATES 2-OFF
TAP 2 BA
No 27 DRILL
DATUM.
10"
ORDINATES 1" SPACING
2 CONTOUR OF REFLECTOR 10" WIDE 1-OFF
DATUM
3 SUPPORT MEMBER
No 27 DRILL FOR 4BA.
7 5/8" CRS.
3/8" DIA. HOLES
4 COVER PLATE
No 27 DRILL FOR 4BA.
TO SUIT CABLE.

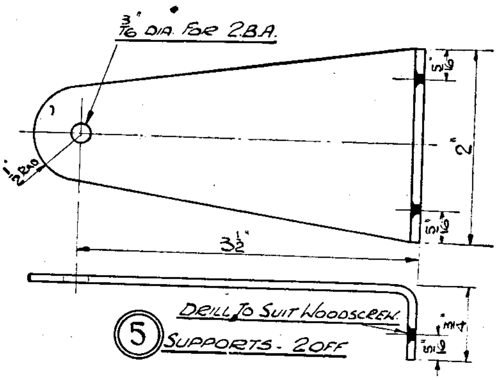
diameter, to allow the rods to be insulated from the metal. The insulators consist of mica washers and I obtained mine from an old sparking-plug.

Cover Plate (4)

This is bent up from any available



material of about 22 s.w.g. and drilled as indicated. The hole in the centre is to accommodate the cable and the raw edges of this hole should be protected by fitting a ferrule made from aluminium or a rubber grummet.

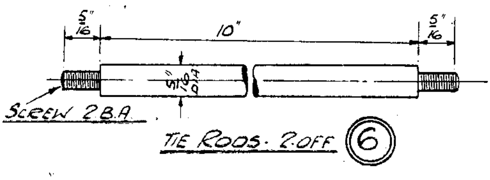


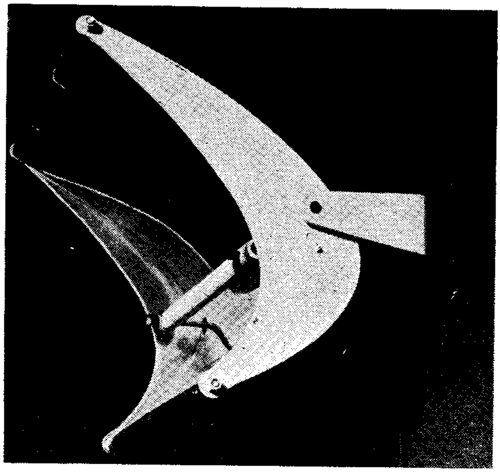
The angle support brackets (5) are made up from 16 s.w.g. M.S. plate, and call for no special comment.

The tie rods (6) are turned up from 5/16 in. diameter M.S. bar ends screwed 2 B.A. or 3/16 in. Whit.

The method of fitting the handle (7) is shown on the drawing, the handle itself being bent up from $\frac{1}{8}$ in. diameter M.S. rod.

A drawing of the base is not shown, as it merely consists of a suitable piece of





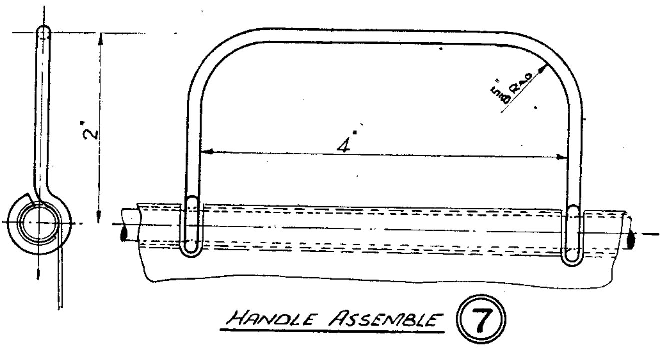
Showing the fire mounted on the wall.

hardwood, size 12½ in. × 2¾ in. × 1 in. thick, stained and polished.

The assembly can be clearly seen from the reproduced photographs, but should be done in the following order.

First, assemble the rods holding the element, on to item 3, care being taken to ensure that these rods are central in the $\frac{3}{8}$ in. diameter holes, and mica washers should be cut to locate these. The mica washers (about $\frac{5}{8}$ in. diameter) are fitted each side to a thickness of about 1/16 in., with a steel washer on top, being finally clamped up with the two ends of the electrical cable.

Next, attach this member between the two side plates with two 4 B.A. bolts.



The reflector is next to be fitted, having first cut the two ¾ in. diameter holes to clear the 3/16 in. rods; also two slots for the handle. It should be given a final polish before assembling between the two side plates. The two connections having already been made to the cable, an earth connection

(*Continued on page* 204)

The Radial-Square

By JOHN WILSON, B.Sc. (Eng.), A.M.I.Mech.E.

IN engineering work, large or small, too much emphasis cannot be laid on the importance of marking-off.* Certain marking-off tools are employed for this purpose, and the commoner ones are well known. Not so common is the radial-square, which is used by tradesmen on circular shafts and cylindrical surfaces. Like many tools, its function is dependent upon the principles of simple Euclidean geometry. In this tool, the chord property of a circle, which states that the perpendicular bisector of the chord passes through the centre of the circle, is involved. If a tradesman wants to draw a radial line on a shaft end, or on a circular ring, he uses this property through the

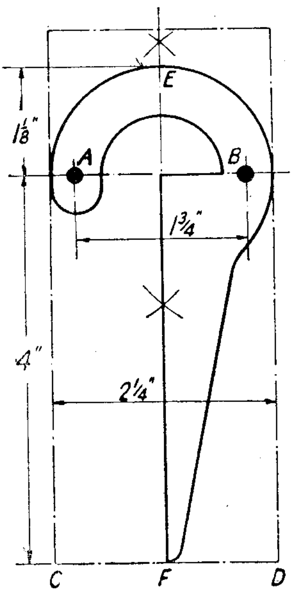


Fig. 1.

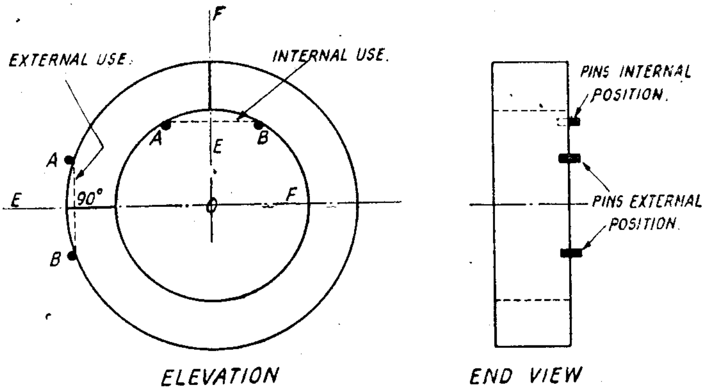


Fig. 2.

medium of the radial-square, which may be any convenient size, and is easily made.

The best material from which to make this tool is sheet iron of reasonable rigidity, say from B.G. 7 to 12. The thickness, naturally, will vary with the size and use, but should definitely not be more than B.G. 12 for small work, e.g. model making. The iron must be flattened thoroughly, and set out, as in Fig. 1, before cutting. *AB* are two points, $1\frac{3}{4}$ in. apart on a straight line parallel to edge *CD*, and say 4 in. from it. "Dab" the points *A* and *B*, then bisect the line, and carefully draw the bisector *EF* with a scriber, or draw-point. Again, with a centre-punch, "dab" in *EF* lightly, drill holes $\frac{1}{8}$ in. diameter at *A* and *B*, fit wire rod or dowel pins to these holes so as to project $\frac{1}{4}$ in. on either side, and finally cut to the desired pattern. The pattern is not important, but the straight edge *EF* must be "trued" perpendicular to *AB* when finished, as per the bold outline in Fig. 1.

The sketch in Fig. 1 is that of a radial-square, metal B.G. 10, used by the writer in a marine engineering shop.† The size is convenient for marking radial lines on such components as flanges, solid and circular shafts, serration rings for turbine diaphragms, rotors, flexible couplings, and circular jigs, etc. As a rule, a short line only is required, but if a longer one is necessary, a radial-square twice as big would be preferred. On the other hand, model parts in amateur or in professional workshops could be served excellently by a square half the size of the illustrated one.

The radial-square has this great advantage, it can be used either externally or internally. The sketch, Fig. 2, demonstrates and shows the tool in position in elevation and end view. It further makes clear how the pins *A* and *B* of Fig. 1 form chord-points when resting on a circular plane surface, and how the blade direction *EF* determines a straight line which must pass through the centre *O*. Of course, it is necessary to draw only a part of the radial line. The remainder can be scribed, if a shaft, by means of vee-blocks and an engineer's square, or, if a ring, can be "picked up" geometrically. The perpendicular centre line can also be likewise found.

* See "The Marine Steam Turbine, From the Point of View of Shop Practice," by the Author (p. 19, *The Shipbuilder and Marine Engine-Builder*, Jan., 1942).

† Messrs. John Brown and Co. Ltd., Clydebank.

A Worm-wheel Cutting Attachment

By ALFRED COX

THE worm-wheel cutting gear described in the following notes, and fitted to a 4-in. "Pools" lathe, was made for cutting the teeth of the worm-wheel on the small spindle shown in Fig. 1. This spindle was for a special purpose and carried a disc-cutter on the eccentric part, and normally did not revolve, but required to be turned round slightly occasionally for adjustment purposes. The worm gearing with it was ⅜ in. diameter screwed standard Whitworth thread. The teeth of the worm-wheel were cut with a ⅜ in. Whitworth tap. Both spindle and worm were of steel.

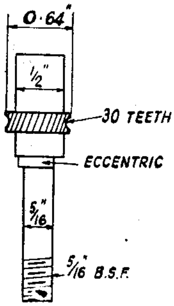


Fig. 1.

All the worm-wheels I have cut so far have been done using standard taps for cutting the teeth, and the taps have cut very well, and give quite a good finish to the teeth. I hope, however, soon to make a proper hob for cutting correctly-shaped teeth for worm-wheels for dividing gear, ball turning, light power drives, etc.

Once the gear is set up, there is no dividing to do, as hob and blank revolve together, the blank being geared to the lathe mandrel.

No castings were used in the construction, steel being the only material used, except for bearing bushes, and the lathe change-wheels are used to gear the attachment to the lathe mandrel. A pair of small bevel wheels are required, and also a master worm and worm-wheel.

The general arrangement is shown in Figs. 2, 3 and 4. "A" is a steel plate fitted in place of the usual screw-cutting quadrant, which is removed. At the top of "A" is mounted the last gear-wheel of the driving train, this wheel being secured to sleeve "B" by one of the collars "C" used for fixing the usual screw-cutting wheels. Sleeve "B" runs in bush "D" fixed in plate "A." This bush projects through "A" to form a spigot for flat steel bar "E" on which the intermediate gear-wheel is mounted. The driving shaft "F" slides through the sleeve "B," being fixed in any position by the snug-screw of the collar "C," and the other end of this shaft carries the bevel gear "G," which is secured by a taper pin. Another bevel gear, "G2" is a sliding fit on the worm spindle "H." "G2" has a snug-screw having flats engaging in a feather-way in worm spindle.

The housing "I" for the worm and worm-wheel is machined out of a solid steel block. The vertical spindle "J" on which the master worm-wheel is fixed is a very important part, as the worm-wheels to be cut are mounted on top of this spindle. Because of its short length it is essential to make it a good fit in its bearings, as any slack here will have a detrimental effect when cutting the worm-wheels.

The bevel gears are supported in the bracket "K," and the bevel gears run on their own bosses.

Now, to describe the various parts: "A," which we will call the supporting plate, fits over the end of the lead screw, and is held in place by the screws which normally hold the screw-cutting quadrant in position. The angle at which it is fixed had better be left until bracket "K" is in position, so as to get the shaft "F" in line with the axis of the lathe. "A" carries at the top the bar "E," pivoting on bush "D," and slotted at one end for stud for mounting the intermediate wheel, and this bar is fixed in position when the gears are in correct mesh by a set-screw.

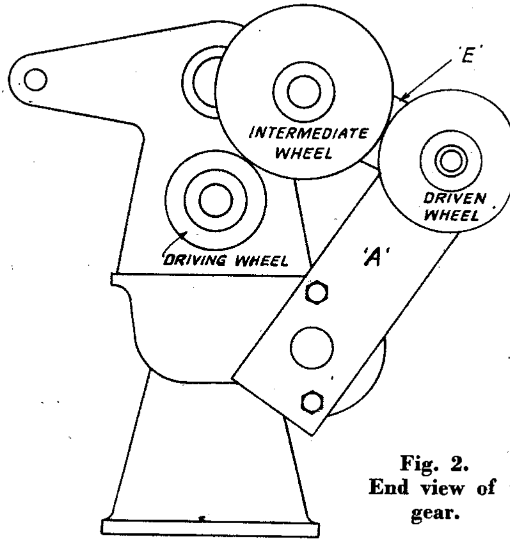
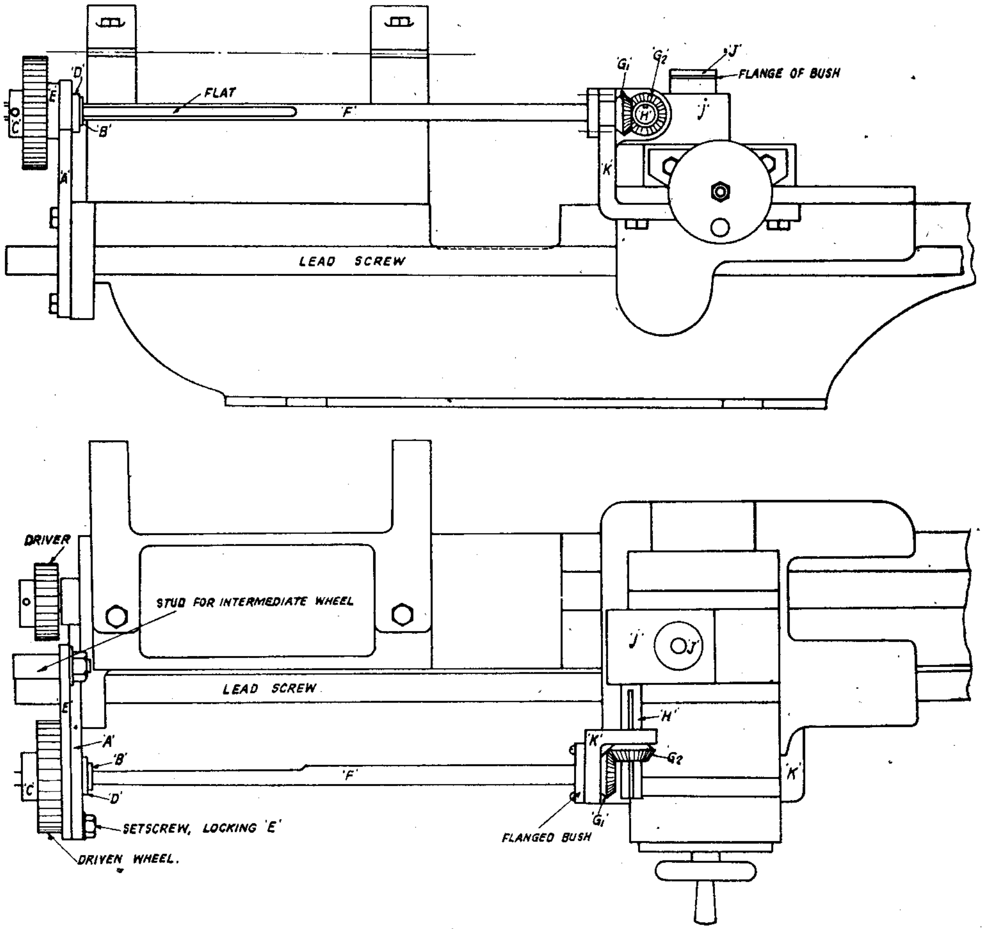


Fig. 2. End view of gear.

The driving wheel of the gear train is



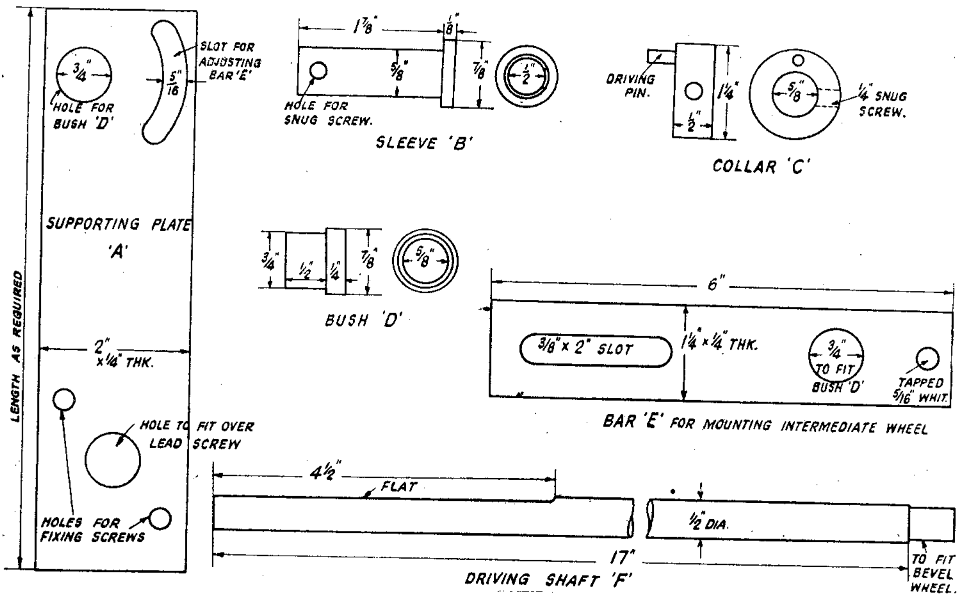
Figs. 3 and 4. Front elevation and plan.

fitted in the usual position, on the tumbler-gear spindle.

As regards the bevel gears, mine came out of an old type sewing machine, and are $1\frac{1}{4}$ in. outside diameter $\times$ 24 teeth. The bracket "K" in which they run was formed out of 2 in. $\times$ 2 in. angle-iron, with thick webs. Part of one web was cut away, and the other web bent at right-angles. As the bevel gears could not be assembled if both holes in which they run were left plain, one of the holes is slotted, and a flanged bush secured, by screws provided, the other hole not being bushed. Bracket "K" is screwed to the front under-side of the saddle with two 5/16-in. set-screws. The drilling and tapping of the holes for these screws was the only job on the lathe itself. It is essential to have the holes for the bevels in the bracket, in the correct position, especially the plain hole in which the bevel for driving the worm runs, as here we have three bearings in line (two in housing "I"), and if one bearing is a little out, there will certainly be binding.

The master worm and worm-wheel were a problem. I happened to have the worm, but no worm-wheel. However, I found a gear-wheel which fitted the worm very well, considering that the gear-wheel teeth were, of course, straight across, and not sloping as they should be in a proper worm-wheel. It happened to have, also, twenty-one teeth, which was very suitable, as will be clear when we consider what train of wheels to set up to cut a given number of teeth on a worm-wheel. In most cases, readers will have a suitable gear-wheel to act as a worm-wheel, but will have to turn a worm to use with it.

I used a solid block of steel to form the housing "I" for the worm and worm-wheel. All the bearings in it must be a good fit, especially for the vertical spindle "J," to the top of which the wheel to be cut is mounted. As space is limited here, and the bearing bushes cannot be very long, make

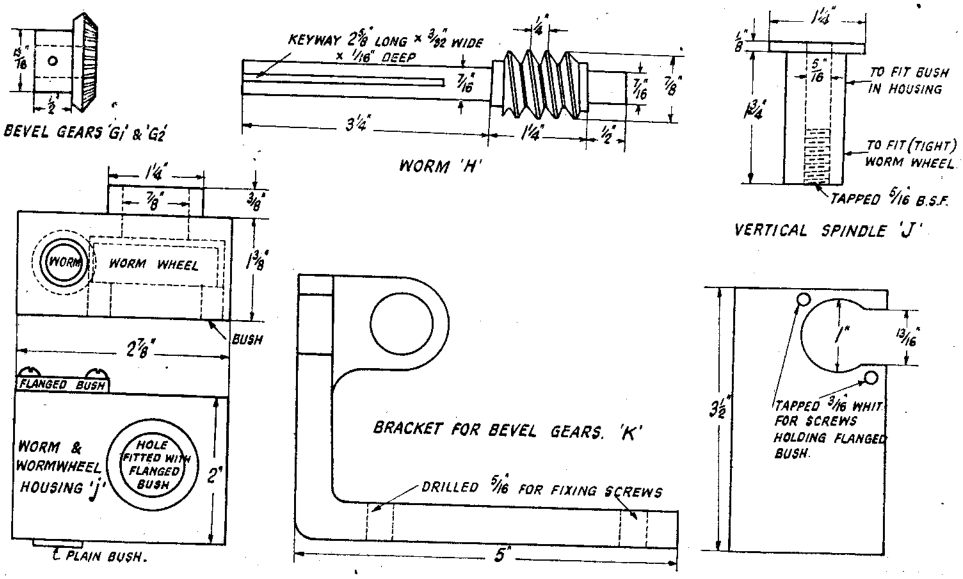


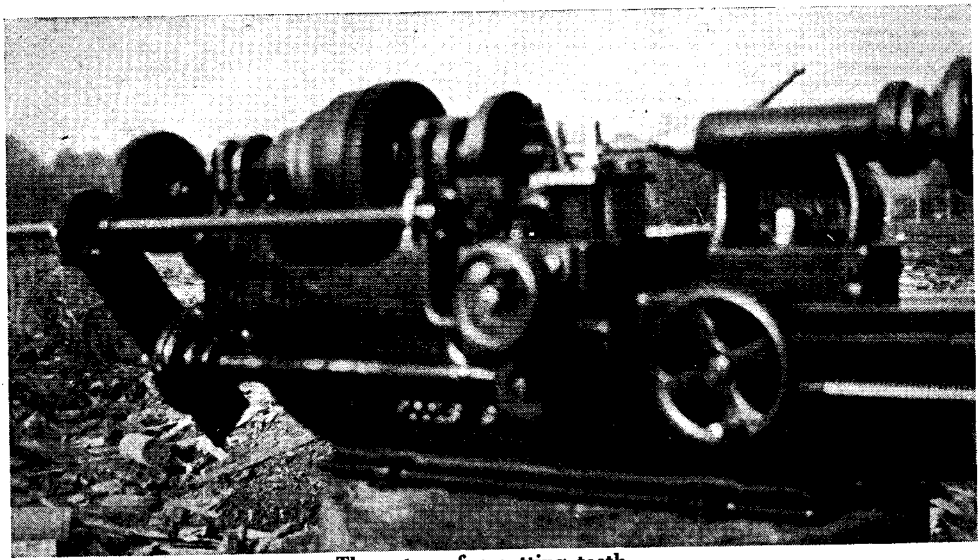
them tight rather than slack. The boss of the worm-wheel forms the bottom bearing, running in a large bush. The bearings for the worm spindle are a bushed hole in the housing on one side and a larger, flanged bush (for assembly purposes) held by screws, on the other side.

The vertical spindle " J " has a flange on top, on which the worm-wheel blanks can be mounted, a hole through the spindle, threaded at the bottom, serving to hold a stud for fixing purposes.

The housing " I " is held down on the cross-slide by a plate with a hole in the centre fitting over the turned boss at the top of the housing, and four special bolts.

To set-up for cutting the teeth, the worm-wheel blank is mounted on the top of the vertical spindle, the centre of the blank's thickness being brought to exact centre height by means of a packing-piece, recessed on the under-side to fit the flange of the vertical spindle, and the top turned to fit the bore of the job. The blank is then clamped down by a stud in the centre hole, and a nut. (In the case of the special spindle, Fig. 1, this screwed directly into the vertical spindle.) A suitable tap is now mounted





The set-up for cutting teeth.

between the lathe centres, and a short carrier, with a square hole to fit the tap, used for driving. A short carrier is necessary, in the case of small taps, to clear the housing "I." In the case of larger taps, the squared end is sufficiently clear of the housing to enable standard carriers to be used. Also, a special driving pin, close in to the centre, must be arranged on the driver plate, when using small or short taps.

The tap used should be a taper one, and the saddle moved along the bed, so that the tap does the cutting with those threads that are only slightly backed off. To move the saddle along the bed, slacken snug-screw in collar "C," allowing the driving shaft to move through sleeve "B." When the saddle is in the right position it is locked, and the snug-screw tightened in collar "C."

If, now, the gear-wheels have been set-up, the lathe can be started, when the job will revolve also. The cross-slide can now be run in to start the cutting of the teeth and fed in gently until the proper depth of tooth is reached. Use plenty of cutting oil.

To decide on the train of gears necessary to cut a given number of teeth, remember that the job has to revolve slower than the hob in the ratio of

$$\frac{1}{\text{number of teeth required in worm-wheel.}}$$

In the case of Fig. 1 with 30 teeth, the job revolves 1/30 of the speed of the tap (or hob). The master worm and worm-wheel gives a reduction of 1 : 21, and the further reduction required can be determined by the simple equation :

$$\frac{\text{driving gear-wheel}}{\text{driven gear-wheel}} \times \frac{1}{21} = \frac{1}{30}$$

Let us assume our driving gear-wheel has 21 teeth—the same as the master worm-wheel—then the equation becomes :

$$\frac{21}{\text{driven gear-wheel}} \times \frac{1}{21} = \frac{1}{30}$$

The twenty-ones will cancel out, and it then becomes clear that the driven wheel must have 30 teeth. This leads us to the simple fact that if we always use a driving wheel having 21 teeth, then the driven wheel must have actually the same number of teeth as we require cut in our new worm-wheel. In my case I did not have a 21-tooth wheel, but a 42-tooth wheel is supplied with the "Pools" lathe. So, using this 42-tooth wheel, the driven wheel had to have 60 teeth to cut 30 teeth in the worm-wheel.

Of course, the 21-T. wheel (or rather, in my case, the 42-T. wheel) cannot be used in all cases, one has to manage with the wheels supplied. I have just cut a worm-wheel with 84 teeth × 1/10 in. circular pitch, the cutting being done with a $\frac{3}{4}$ in. Whitworth tap. For this, applying the equation :

$$\frac{\text{driving wheel}}{\text{driven wheel}} \times \frac{1}{21} = \frac{1}{84}$$

$$\text{Since } 84 = 4 \times 21, \quad \frac{\text{driving wheel}}{\text{driven wheel}} = \frac{1}{4}$$

so I used a driving wheel with 24 teeth, and a driven wheel with 96 teeth.

Wheels to be used depend on the master worm-wheel, and for readers whose screw-cutting wheels start at 20 teeth and increase by 5s or 10s, a master worm-wheel having 20 teeth would be suitable, but the above equation can be applied just the same, the reduction due to the worm and worm-wheel being 1/20 in this case.

*Small Capstan Lathe Tools

Notes on "tooling up" for repetition work, with special application to the small capstan attachment recently described in the "M.E."

By "NED"

APOLOGIES are due to readers for the long break in this series of articles, caused by an unusually heavy spell of war work. It would appear, from the queries received as to when the articles would be resumed, and also on several specific points regarding production tooling, that many readers have found the subject interesting and helpful. Although it has not been possible to reply individually to these queries, they have been carefully noted, and it is hoped that, in due course, some information on the matters in question can be included in these articles.

An "Automatic" Collet Chuck

One or two readers have asked for a design for an "automatic" collet chuck (that is to say, one which can be opened and closed without stopping the mandrel) applicable to model engineers' lathes which have been equipped with a capstan attachment, or otherwise tooled up for production. It is true that nearly all modern bar-turning capstans are equipped with such a chuck, and that it saves several seconds in the time taken for producing each individual piece, thus saving a good deal of time on a long production run. But most of such lathes have the mandrels specially designed to accommodate the chuck mechanism, which usually incorporates a draw or compression tube passing right through from the nose to the tail end. As most small model lathes have only a small bore through the hollow mandrel, it is clear that the use of such a tube would seriously reduce the bore capacity. The only alternative is to employ a chuck in which all the mechanism is incorporated in a self-contained unit on the mandrel nose. It is by no means easy to arrange this without introducing excessive overhang, but it is not impossible, and some rough sketches have already been made of such a chuck, which is suitable for application to most of the small lathes used by readers, and is within their ability to produce. Should there be a general demand for a chuck of this type, the design will be completed and submitted for publication.

* *Continued from page* 378, *Vol.* 85, "*M.E.*," *November* 6, 1941.

Running-Down Tools (continued)

The last tool of this type to be dealt with was a simple box tool with a bush steady, which, as pointed out, is capable of quite accurate and well-finished work within its capacity, but has certain limitations in respect of the range of sizes of stock it is capable of handling. As the steady bush must necessarily engage the work in advance of the tool, its use is also confined to operating on smooth, true-running stock, of sizes within close limits of that of the standard bushes, or work which has already been run down to an accurate standard dimension.

In order to extend the range of application of the running-down tool, a form of steady which is universally adjustable to any size

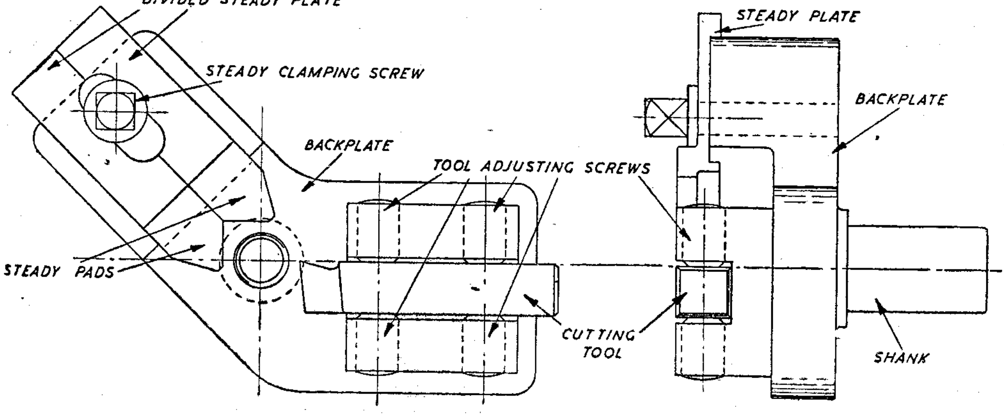
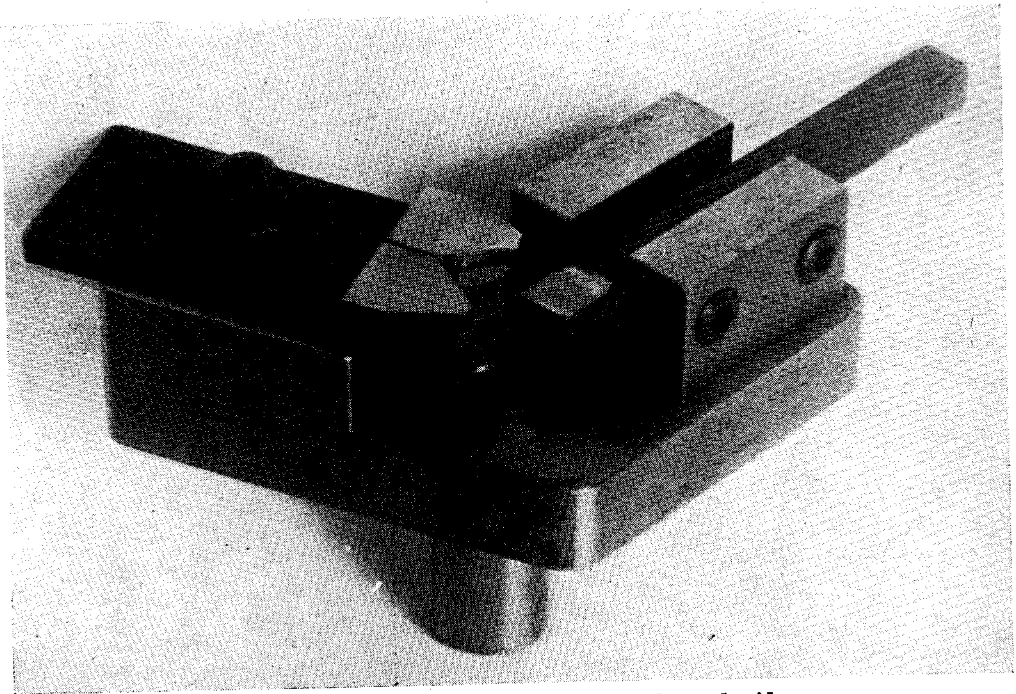


Fig. 8. Vee steady open tool-holder.



The vee steady tool-holder, seen from the underside.

of work within its capacity, and may also be adjusted in the direction of the work axis, so as to either " lead " or " follow " the tool point, must be employed. There are innumerable varieties of such tools in continuous use on production work, most of them incorporating vee or roller steadies, and in many cases having provision for carrying more than one cutting tool, so that roughing and finishing operations, or stepped diameters, may be carried out simultaneously. Generally speaking, the single-point tool will be the most useful for the class of lathe we are discussing, because quite apart from additional power requirements, and torque strains, imposed by multi-tooling, there are other disadvantages in making and maintaining adjustments of the tool-holder, which may more than cancel out the advantages which they offer in increasing the speed of production.

A Vee Steady Open Tool-holder

The device illustrated in Fig. 8 is an example of a tool-holder which has proved successful in actual use and is of quite simple construction. Being of the open type, it gives less trouble in respect of swarf clearance than the usual form of box tool, and also promotes accessibility. The shape of backplate used is of little importance, so long as the relative positions of the tool point and the jaws of the steady are maintained. It will be seen that one jaw of the steady makes contact with the work dead opposite the tool point, while the other rests on the top of it, i.e. at right-angles, so that the normal 90-deg. vee angle of the jaws is employed. This is the logical setting of the steady, as it thus prevents the work either from bending away from the tool, or " riding " over the top of it, but occasionally one encounters steadies having a different included angle, or angular setting in relation to the tool, for which certain advantages are claimed. These should be judged on their merits, as proved by actual test ; most tool-setters, however, would, it is believed, endorse the view that the normal arrangement of the steady is difficult to improve upon.

Refinements

There are one or two minor refinements in the design of this steady which may be worthy of comment. It will be seen that the steady-plate is divided, so that the jaws may be adjusted individually up to the work, and simultaneously clamped by a single set-screw having a collar or washer under the head. This feature is not necessary in cases where the true axial alignment of the holder with the work axis is beyond suspicion, and may even be a positive nuisance in these circumstances, but it is very useful when errors of alignment exist.

The jaw-plate is stepped or "joggled," so that it may be used either in the position shown, which brings the steady pads slightly in advance of the tool point, or turned over so that they come slightly behind the tool point.

In the former position, the tool provides the maximum support for dealing with heavy cuts on slender work, provided that the stock runs truly and is well finished ; in the latter, the stock must be sufficiently rigid to enable the tool to cut properly for the short distance before the steady is engaged (unless this is done by a separate operation) ; but when once properly started on the cut, the follow steady produces the highest dimensional and concentric accuracy, and is independent of the external condition of the stock.

Hardening and Polishing

The steady jaws must be hardened and highly polished to avoid the possibility of scoring of the work, or seizure, in the event of lubrication being inadequate ; they should be as wide as possible to increase bearing surface, subject to the limits imposed by end room, or the need to bring the tool close up to the chuck, or a shoulder on the work. Generally, however, narrow jaws are a sheer necessity, for these reasons.

Both the steady-plate and the cutting tool are carried in slotted blocks, which may be bolted, riveted, brazed or welded to the backplate, and the latter similarly secured to the shank, or bolted to the capstan face.

It will be seen that the tool is secured in the tool block by two sets of Allen or other sunk set-screws, one above and the other below. This is a very useful refinement, as it allows the tool to be adjusted to correct height after regrinding, a provision which is sadly lacking in the simple box-holder, and may cause trouble after some wear of the tool has taken place. Some users, however, may prefer to use packing under the tool for this purpose.

Another way in which height adjustment of the tool may be effected is to make the tool block with a turned spigot or shank, which is clamped in the backplate instead of being rigidly attached to it. Adjustment is thus effected by loosening the clamp and turning the block slightly ; this method is satisfactory, so long as the clamp can be securely tightened and the tool is not overloaded.

Vee steady tools generally are better suited for machining brass and bronzes than steel, as the surface of the latter may "pick up" and score, under the pressure of the pads, with very little provocation, and the same applies to certain aluminium alloys. The steady must be kept well lubricated, and not allowed to remain in contact with the work when the cut is completed. With proper setting, heavy cuts may be taken, leaving a good finish and accurate dimensions, but a second tool for finishing is recommended in high precision work.

(*To be continued*)

An Electric Fire for the Workshop

(*Continued from page* 196)

should be made by connecting the earth wire of the cable to a nut and bolt in some convenient part of item 3.

Before fitting the cover plate (item 4) I wrapped the cables with asbestos tape, just to be on the safe side ; the cover is then fitted and held in place by two 4 B.A. bolts, 1¼ in. long, passing through the holes provided.

Attachment of the feet (item 5) was made, in my case, by two 2 B.A. bolts, with a double spring washer between the feet and the side plates, the bolts being tapped into the side plates and locked by a nut on the insides. They are tightened up sufficiently to allow the fire to be swivelled to any position and stay put. An alternative scheme would be to fit somewhat larger bolts with knurled locking-screws on the outside.

Before attaching to the base it is advisable to give the sides and back a coat of good quality enamel. It is now only necessary to fit the element and the job is complete.

The photographs show the finished fire, and, as can be seen, it can be either used standing on the floor or mounted on the wall ; if floor space is limited, the latter position is better, as it can be adjusted to reflect the heat downwards.

*LOCOMOTIVE HEADLAMPS—

By F. C. HAMBLETON

No. 2—Southern Railway Group—L.S.W. Railway

THE advent of the small square type of headlamp may be said to be due to John Ramsbottom, who took charge of the L.N.W.R. at Crewe in 1857. At that date large, rather than small, lamps were the order of the day, but that excellent engineer, William Adams, when appointed to the L.S.W.R. in 1878, introduced a small lamp which was very much a copy of that designed by the great Patrick Stirling for the G.N.R. fliers. This in its turn, was a lamp remarkably like the L.N.W. one, and which will be described in due course. But to return to the L.S.W.R., Adams's lamps, Fig. 1, presented quite a number of interesting features. Although small (the body measured only 5 in. by 5 in. by 6 in. in height), they were very solidly built, and were quite heavy. This was partly due to the fact that the lamp-iron, in itself a solid affair, was riveted to the back of the lamp, quite a reversal of the usual order of things.

There were two doors, one at the right-hand side, the other in front, on which was mounted the small 4½-in. lens. This door was fashioned so as to provide a pocket which could contain a coloured shade when necessary. In order to protect the flame from being blown out, since this pocket was not airtight, or should the door accidentally come open, a sheet of clear glass was fitted to the circular opening in the body of the lamp. Strange to relate, however, if that door did swing open the shade fell to the ground with a crash, with disastrous results to the glass—a mishap not totally unknown today; for it must be explained that many of these otherwise excellent lamps are still employed on the Western section of the Southern Railway.

* *Continued from page* 141, "*M.E.*," *February* 5, 1942.

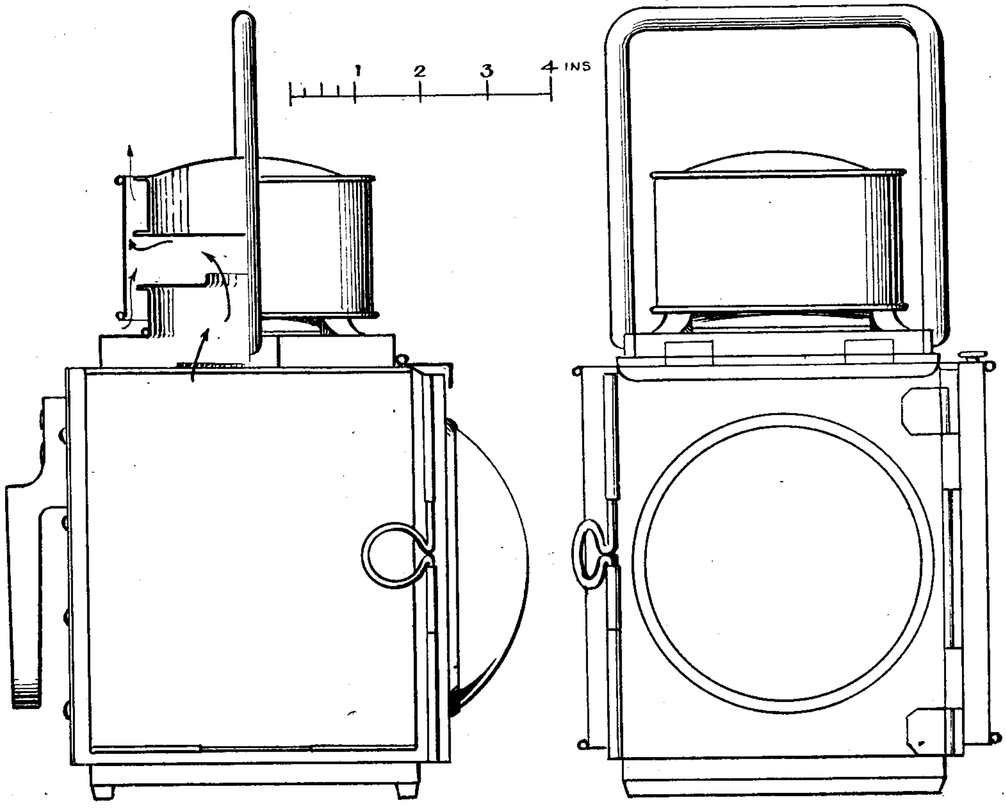


Fig. 1. L.S.W.Ry. Adams's headlamp.

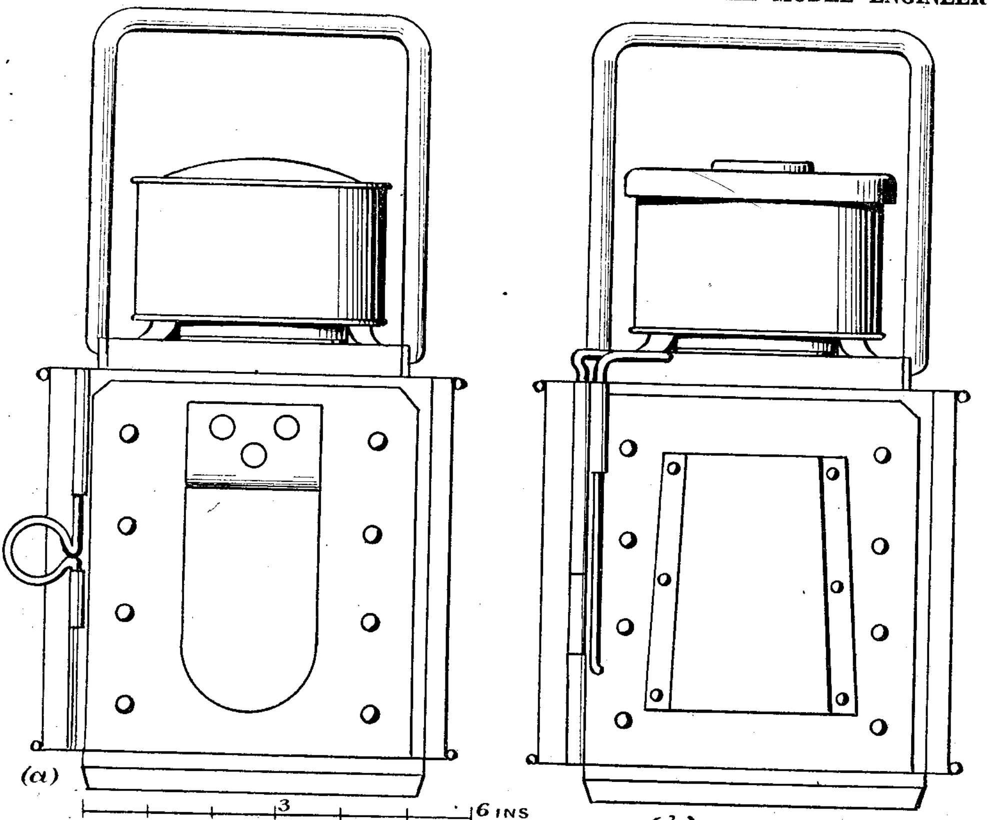


Fig. 2. (a) L.S.W.Ry. (b) Southern Railway.

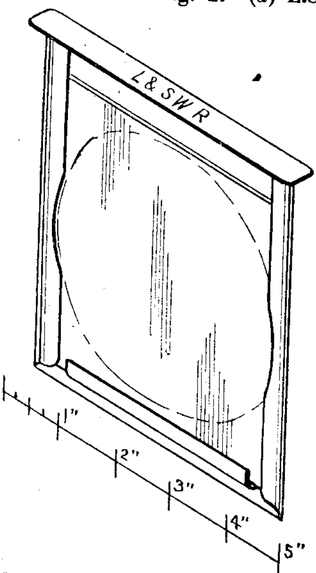


Fig. 3. Red, green, or purple shades.

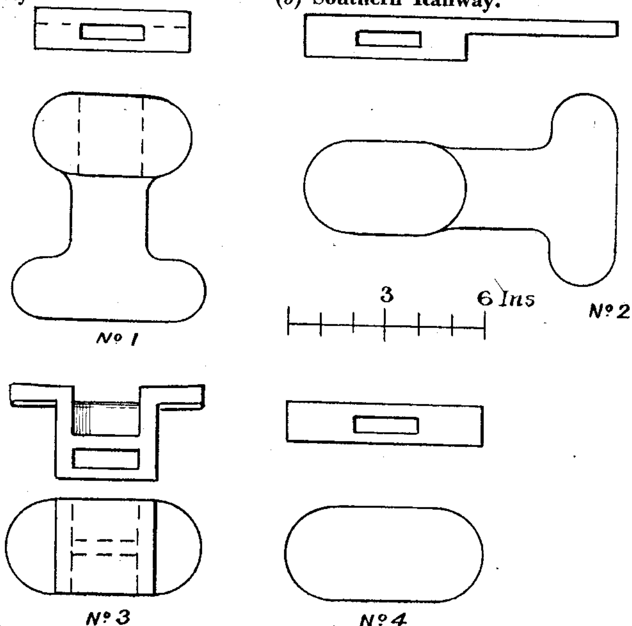


Fig. 4. Adams's lamp brackets—No. 1, Base of chimney. No. 2, Smokebox side bracket. No. 3, Smokebox door. No. 4, Bunker and storage on tender side.

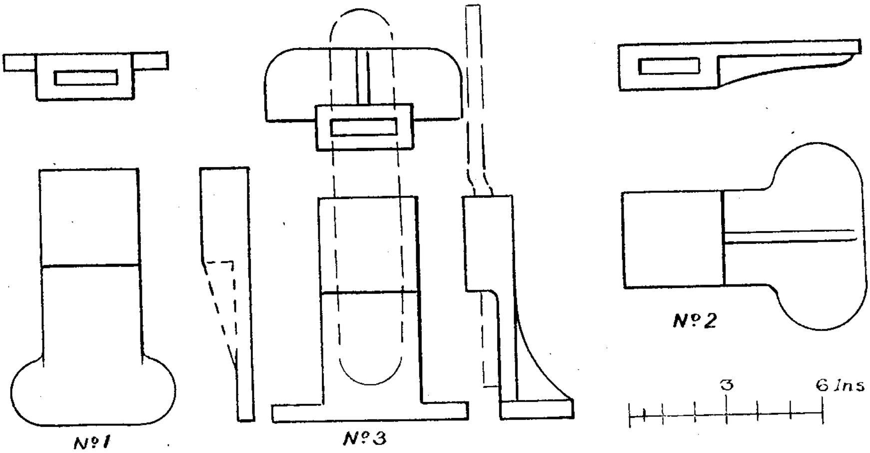


Fig. 5. L.S.W. Drummond's brackets—No. 1, Base of chimney. No. 2, Smokebox side. No. 3. Buffer beam bracket.

Recent Changes

Fig. 2 shows the change made in recent times at the back, sketch *b* indicating the newer dashboard riveted to the lamp, the lamp-irons nowadays being attached to the footplate of the engine. A difference in the door catch and the top will also be noticed. Two strengthening ribs were fixed transversely across the bottom of the lamp, and on either side were two pockets for the storage of the coloured shades, Fig. 3.

The London & South Western head-code of that day required four positions, one at the base of the chimney, one either side of the smokebox at its centre-line, and one in the middle of the buffer beam. A fifth was added when the L.S.W. took over the Southampton Docks in 1892, and this one was situated immediately above the smokebox door handles. All this necessitated four different types of lamp bracket, Fig. 4. In this sketch No. 1 represents the ones placed at the foot of the chimney, and in the centre of the buffer beam. The latter was bolted to the face of the buffer beam, since, unlike most engines, the footplate did not project in front of it. No. 2 shows the brackets for the smokebox sides, while Nos. 3 and 4 indicate the shape of those attached to the smokebox door and to the bunkers of the tank engines respectively. When Mr. Dugald Drummond succeeded Wm. Adams at Nine Elms the old code with its red and black cross headboards was abolished. The new code was much simpler, for it employed only a circular and diamond board, both of which were painted white, and which at night were replaced by white and green lights respectively. But it required six lamp brackets, the two new ones being placed over the buffers. However, the bracket marked No. 4, Fig. 4, was not taken off the side of the Adams's tenders, in which position it had served as a storage bracket, but it did not appear on the sides of the Drummond tenders. It is strange that Drummond did not introduce the cylindrical lamp which he had used for so long a time in Scotland. He evidently approved of the Adams's type, but he did modify the brackets, giving them square corners and strengthening ribs, Fig. 5.

Bracket Modifications

Those on the footplate were attached to its upper side in the customary fashion, since the footplate overhung the buffer beam in front. No. 1 in Fig. 5 shows the two types he placed at the chimney base, the inclined dotted lines belonging to those on the 4-4-0 "706" class. The dotted lines in No. 3 give the shape of the lamp-iron used today by the Southern Railway on Drummond engines. In the new code, mentioned above, the nearside buffer lamp-iron was exclusively reserved for the "Special Train" indication, and carried by day a white headboard with a black spot, and by night that most unsatisfactory of colours—a purple light. As the glass used was very thick, the resulting light was correspondingly poor. The Adams's lamps were painted black, changed by the Southern Railway to red, and by reason of their pleasant appearance would greatly enhance models of the many handsome types of locomotive which belonged to the London & South Western Railway.

(To be continued)

Changing its Nationality!

By "L.B.S.C."

A FOLLOWER of these notes purchased at a reasonable figure (reasonable, that is, for these days!) what he calls a "Yank" locomotive which had not seen a great deal of service. The workmanship was fairly good, but the engine is an indifferent performer, and needs rebuilding with a few "monkey glands" incorporated in its anatomy. The new owner is quite capable of undertaking this job; but he says, as the engine is far from being 100 per cent. American, and British so-called "standard" parts were freely used in its construction, how about turning it into a British type engine whilst it is "in the shops." It is a 4-6-4, and he thinks it might be made to look something like a L.N.E.R. "Flying Scotsman," or a L.M.S. "Duchess."

Great minds still think alike! I had a friend in the Nottingham district who, alas! passed over the Great Divide a year or so ago, with an internal complaint which proved incurable. He built a locomotive to the first instructions ever given in the "Live Steam" notes, to wit, a gauge "1" "Ford" Pacific, which ran very well for a number of years. Some time before his death, when the engine needed heavy repairs, he decided to convert her to British outline, and had nearly finished the job when he took his last sad journey.

A Similar Conversion

At odd intervals, during the last year or so, your humble servant has been engaged on a similar conversion. I mentioned it when describing the gauge "O" *County of Rutland*. Soon after the description of *Josie*, the gauge "O" American 4-6-4, appeared in the "Live Steam" notes, a correspondent commissioned Bassett-Lowkes to build one for him to the published specifications. To the best of my knowledge and belief, the job was undertaken personally by their Mr. J. Braunston; and except for variations in the steam pipe connections, boiler fittings, and other minor details, the locomotive agreed with my specifications. It was the first coal-fired "O" gauge engine the firm had ever turned out, and they had a pleasant surprise when the customer reported, that acting on the correspondence instructions I had given him for driving and firing it, the engine made light work of hauling seventeen bogie coaches continuously at a high speed.

Circumstances which I need not mention here, ultimately caused the owner to give up his railway, and the whole of the equipment was disposed of, the American engine eventually coming into my possession. By now, it needed overhauling; the boiler leaked, and some of the fittings were broken. As I wanted to make certain experiments with a gauge "O" water-tube boiler, I decided to repair the engine and fit it with a new boiler of that type. Then along came an old friend with a request for a gauge "O" spirit-fired L.M.S. "Duchess." Like myself, he is getting well along the Great Railroad of Life, and had decided to dispose of his existing 2½-in. gauge locomotives and passenger-carrying equipment, and go in for an "O" gauge "scenic" line, as this could be operated indoors, and didn't require as much physical exertion as running the larger engines on an outdoor track.

I'm always anxious to kill two birds with one shot wherever possible (wish they were Adolf and Musso!), so I thought it would be a good wheeze to convert the erstwhile *Josie* into a "Dutch cheese" whilst I was about it, and let my friend have her when I was through. The transformation was actually in hand before I started building the engine which commenced its career as a "Bat," but went "Great Western," and Great Westernlike, caught up and passed the rebuild! At the time of writing, the job is nearly finished, and maybe a few words on the alteration would help our friend who wants to convert his 2½-in. gauge engine likewise.

Overhaul and Alterations

There is no need to go into detail about the overhaul, as that was a plain straightforward job. As the engine was, as far as working parts were concerned, a copy of the original *Josie*, there were no alterations to make; but I found one error, and will mention it here because it is frequently made by both amateur and professional workers.

When feeding two or more cylinders from one source of oil supply, it is not only essential to keep the oil pipes the same length, but the steam and oil connections must never be arranged so that oil is expected to flow *against* the current of steam, because it just won't do it. On this engine as originally built, the cross steam pipe was attached to the cylinders by flanges screwed to the front of each steam chest, instead of as called for in my specification, and whilst the lubricator delivery pipe was connected to the centre of this pipe,

which was O.K., the steam connection was made at a point quite close to the right-hand cylinder, which was entirely wrong. Consequently, steam flowing to left-hand cylinder passed the point where the oil entered, and took all the oil with it, so that the left-hand cylinder got the lot, and the right-hand one emulated Mother Hubbard's dog all the time the engine was running. A little trickled through when the lubricator was being filled, and it got an occasional gulp when steam was shut off; but the condition of the two bores, when I took the cylinders off, told the tale plainer than any words. The steam entry was therefore altered to come into the cross pipe directly opposite the oil entry, so that each cylinder got its equal share of the oil spray.

The engine, of course, had bar-type frames, and a pilot-beam casting carrying the pilot or "cowcatcher," which fitted were connected by a cross-stay, which carried the pivot pin for the trailing four-wheeled truck, a heavy affair with cast side frames, representing the booster truck used on some of the N.Y.C. locomotives. The truck was taken off, and a trailing cradle cut from 18 gauge steel, to the shape of those on the L.M.S. Pacifics. This was brazed to a drag beam made from 3/32-in. by $\frac{3}{8}$-in. steel, and the whole attached to the back of the cross-stay by three 8 B.A. screws.

A L.M.S. type pony truck was made, and attached to the existing pivot pin, and it just had enough side play, before hitting the side members of the cradle, to allow the locomotive to pass around a 4-ft. radius curve. These additions so altered the appearance of the chassis, that nobody would have suspected that she was ever American, unless they took a close look and recognised the bar frames in the centre part.

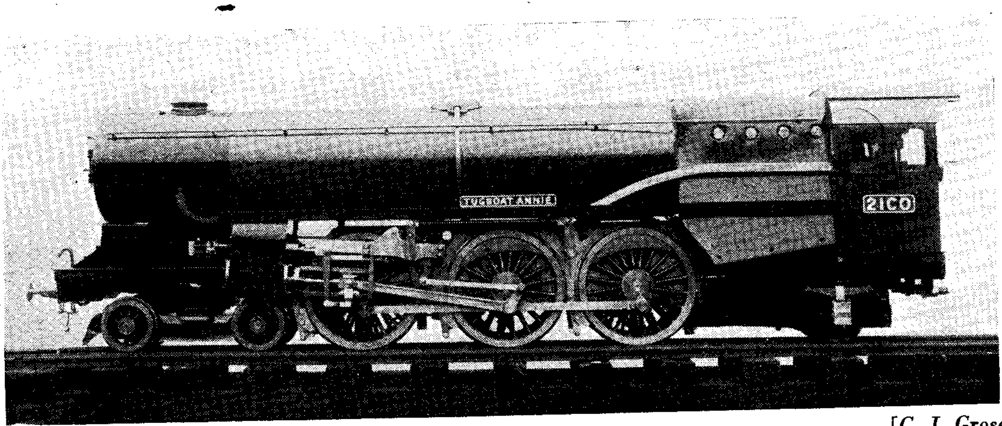


Photo by] [*C. J. Grose*

The experimental engine with Holcroft conjugated valve-gear.

between the frames ahead of the cylinders. This casting was taken off, and in its place I fixed a similar assembly made up to represent the front end of the L.M.S. Pacifics. The buffer beam was made from $\frac{3}{8}$-in. by 3/32-in. angle brass, slotted on the top to take a couple of stub frames filed to the shape of the L.M.S. frames ahead of the cylinders, and these were silver-soldered into the slots. The front of the beam was furnished with buffers and coupling as per usual, and the whole lot attached to the projecting lugs of the bar frame, using the existing screwholes. The rear ends of this dummy front frame section butted up flush against the cylinders and smokebox saddle, and the net result was complete "Anglification" of the leading end. A couple of guard-irons were attached to the front of the bogie, to finish it off.

At the rear end, as originally made, the frames stopped short at the firebox, and Something like young Curly, the night he got caught in a sudden storm on his way to the driver's house, and was soaked to the skin. Mrs. Jones wisely made him take all his wet rags off and go in a hot bath, after which she found him a complete warm and dry outfit, which not only fitted him perfectly, but so altered his whole appearance that he went home through the station unrecognised.

Boiler

The new water-tube boiler was a simple affair. I made the outer casing a little larger than the correct L.M.S. size, on account of the smokebox saddle, which would have entailed much unnecessary work had I got it off and machined it to take a smaller barrel; and the difference is not apparent. The barrel is made from 24 gauge sheet steel rolled to 2 in. diameter and lapped, the joint being riveted with bits of domestic pins;

the sloped-in Belpaire casing at the firebox end, is 22-gauge steel, with a throatplate flanged over a former, the joint being Sifbronzed. It is asbestos-lined. The inside barrel is a piece of 24-gauge copper tube, 1½ in. diameter, Sifbronzed to a 16-gauge copper backhead fitting the end of the casing. There are three 5/32-in. water tubes, put in on Mr. Averill's system. Fittings comprise a regulator of the screw-down valve type, with quick-thread screw and L.M.S. handle, one-third of a turn giving full opening; blower valve, test valve for trying water level, and a feed clack. There are two safety valves with ⅛-in. balls, set to blow off at 80 lb. pressure. Neither steam nor water gauges are provided, owing to lack of room, but they are not necessary, as the boiler is very great at blowing off, and a few strokes of the hand pump every few minutes, looks after the water. The engine would merely stop if the boiler ran dry, without doing any harm; and if too much water is pumped in, the safety valves start performing the fountain act, so it is easy to judge the happy medium.

"Poison Gas"

At the present moment, experiments are in progress to find out which type of gauge "O" spirit burner will best fulfil three conditions, viz., greatest amount of heat, lowest consumption of spirit, and total abolition of unburnt fumes. Personally, I detest spirit firing in any shape or form; but as some good folk favour it, I can only do my best to help them. In the course of my experience I have overhauled and repaired many spirit-fired locomotives, amateur, professional and commercial. The majority of them, when tested with their original layout of burners, gave off enough unburnt fumes to warrant the use of a gas mask, the worst offenders being those made by the long-defunct firm of Jubb's. The wick tubes on these engines were invariably made of heavy gauge copper, and as soon as they got hot, the spirit was vaporised to such an extent that sufficient air could not be drawn through the firebox to consume it; consequently, it went out of the chimney unburnt, got down the unfortunate operator's throat, and made his eyes smart and water. I got over most of the trouble on the 2½ in. and gauge "1" engines, by fitting new lamps with burners of very thin gauge tube, large feed pipes, and ample sumps; the blastpipes, blowers and chimneys were arranged to give maximum draught, so that the burners were well ventilated (methylated spirit needs a large volume of air to ensure complete combustion) and as the rush of air kept the thin tubes comparatively cool, excessive vaporisation of the spirit was avoided. The consumption dropped very considerably in addition, and the steaming was improved.

On the little engine, good results have been obtained with a six-wick lamp having 7/32-in. burner tubes, and if nothing better eventuates, it will be permanently clipped to the back rail of the pony truck, and fed from a constant-level sump under the tender, by a rubber hose. This burner keeps cool and does not fume; the flames are diffused and very hot, and the spirit consumption is low. I am in hopes that my friend will be able to run the little engine indoors without using his gas mask, nor making the house reek for days; his fair lady would probably say more than a mouthful about having her curtains and upholstery perfumed with eau-de-meth.

The top works of the little "transformation" follow L.M.S. practice, except that the running-board is straight and has no splashers, owing to the smaller diameter of the driving wheels. The tender is entirely new, as the original twelve-wheeled tender, of the American type, could not by any means have been adapted to British outline. The new one is pure L.M.S. and runs on six wheels, the axleboxes being Bond's hot-pressed "fully-detailed" ones, which look the berries and save a lot of fiddling work. The tank has two compartments, one for water, which also contains the little hand pump ("Bat" type) and the other for spirit. This contains the fuel valve and air pipe for the constant-level sump underneath. As soon as Mr. Grose can take a picture of the little rebuild, I will submit it for criticism, and am open to bet that nobody would ever recognise its original "nationality." At the present minute, it is standing alongside "Tugboat Annie" on my erecting bench—a perfect example of "dignity and impudence."

Our friend who wants to convert his 2½-in. gauge American to British outline, could do so by following the same general course of operations, as far as the chassis was concerned, removing the pilot beam assembly and substituting a buffer beam fixed to stub frames made of plate, screwed to the outside of the projecting bits of the bar frame. A trailing frame or cradle, either L.N.E. or L.M.S. pattern, could be made up complete, and bolted to the rear main frame stay in place of the American cast cradle; and a pony truck, with either plate frame, or cast frame of British type, made to suit. I fitted a new large drum type displacement lubricator on the little engine, between the plates of the stub frame; but should recommend a mechanical lubricator in the same place for the 2½-in. gauge engine. If L.N.E.R. outline is decided on,

the American boiler could be used again, as it has a round-topped firebox ; the only alterations would be to replace the smoke-box front with a ring and door of British pattern, take the sand domes and bell off the top of the barrel, and replace the chimney by a standard " Gresley."

The existing tender runs on two four-wheeled bogies, whereas the L.N.E. have four rigid axles, but to save work these could be left as they are, and a coping put around the top of the tank to give it a British appearance. Only Inspector Meticulous would worry about it ! Running boards and splashers, buffers and couplings, and a new cab would work wonders. It is hardly necessary to add that all overhauling and repair work should be done and the working parts thoroughly tested before the " dolling-up " is undertaken. I hope my correspondent will be able to let us have pictures of the engine before and after conversion ; they would prove a very interesting comparison.

should be ; the soft copper is merely settling itself into the best position to resist pressure.

If all is O.K., pump in more water and take another look at 140 lb. ; if still all right, carry on to 160 or 180, and leave the boiler at the full pressure for a little while. If the pump valves are tight—and they *should* be, with that pressure above the balls—the boiler should hold it without any trouble ; but some folk prefer to fit a screw-down valve in the boiler-bush to which the test-pipe is attached, pump the water through this valve until the desired pressure is reached, and then screw the valve down tightly, to take any strain off the pump, and make certain that if the pressure falls it is getting out of the boiler some place, and not going back through the pump. If, after this treatment, the boiler still shows no signs of bulging nor leakage, you can safely pass it as fit for steam service ; and the next job will be to make the fittings and the smoke-box.

" *MOLLY* "

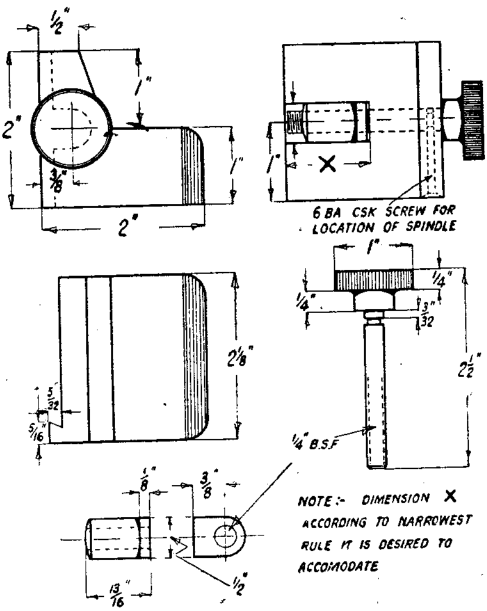
How to Test the Boiler.

First of all, you will need some means of holding the pump still whilst pumping against pressure, so the best thing would be to screw it down temporarily to a small block of wood, so that the whole issue can stand in an ordinary wash-bowl. Make temporary metal plugs for all the tapped bush-holes in the boiler except two, and screw them in with Hallite or similar joint washers under the heads. I keep an assortment of ready-made plugs and adapters for these jobs. Cover the dome hole with a rubber washer, piece of wood, and improvised wood clamps as previously described. Next fill the boiler right up to the unplugged bushes ; then connect one of them to the big pressure gauge already mentioned in a previous note, and the other to the delivery union of the pump, using $\frac{1}{8}$-in. tube, plus unions and adapters to fit the bushes. Pour enough water in the wash-bowl to cover the suction end of the pump valve-box for about an inch, put on the extension handle, hold the pump tightly, and pump until the pressure gauge registers about 100 lb. ; then take a good look all over the boiler, especially inside the firebox, to see if anything is moving.

I don't anticipate that you will be troubled with leakage, for the tinning process effectually deals with any minute leak in the brazing. There should be no bulging between the stays. The crown sheet *may* move to the extent of 1/32 in. or so, but this is as it

A Rule Stand

Many readers have asked for dimensioned details of the rule stand which was described and illustrated on page 488 of the December



18th, 1941, issue of THE MODEL ENGINEER. I hope the above drawing will satisfy all who are interested.—I.B.

Hints on a First Model Steam Boat

By "DISGRUNTLED"

QUITE a number start their modelling careers by making a small steamboat round a bought set of engines, probably with no idea of any very definite type but with a fine firm determination to navigate the local pond under steam. As this is a recruiting ground for the hobby, what follows here is only intended for such and not the expert who may not like it one little bit—*Tôt homines*, etc. !

Now the choice of a definite prototype is all very well, but presuming you are already committed to a ready-made steam plant, your style is possibly cramped from the outset ; also, if you have never tackled this sort of thing before, you don't know what to avoid, but it may be taken as a rough guide that in boats up to about 44 in. long (which is about the limit that can be fairly easily carted about) the maximum length had better not exceed, at most, five times the maximum breadth ; likewise, the maximum depth of the midship's hull section (not draught) is best kept round about a half to five-eighths of the maximum beam.

With these dimensions, and no excess of top weight, the necessity for ballast ought to be avoided, but these ratios will put warships and liners off the menu.

Owing to the possible difficulty of getting hold of a suitable block of wood to work on (which is probably the easiest form of construction) you can usually carve all the bottom lines out of a plank 3 in. thick and of suitable breadth, and then obtain extra freeboard and the fore and aft upward sweep of the sheer plan by adding planks cut out to the shape of the deck plan and sweep. When you do start, remember to scribe your end top and bottom centre lines clearly and firmly, then cut out your deck plan from a folded sheet of stiff paper, open this out and paste centrally on the block ; when you are getting on towards the later coarse sandpaperings, similarly cut out hollow templates from folded paper (stiffened if necessary), and check for accuracy by applying these vertically to the bottom at five or six stations on the hull. When hollowing out leave a fair amount of wood at the ends until you have fitted the shaft and generally know where you are ; if you think you are getting thin, hold the boat up to the light (if you go through, repair with *fresh* plastic wood) about $\frac{3}{8}$ in. to $\frac{1}{4}$ in. on the sides and about $\frac{1}{2}$ in. thickness on the bottom will do, but you can go a little thinner if you are sure of yourself.

The shaft tunnel and stern tube are frequently funked (quite unnecessarily) ; when you get far enough to know the line of these, bore a pilot hole and gradually enlarge it to, say, $\frac{1}{4}$ in. Take a "Meccano" rod and two "Meccano" collars (without the grub screws) and obtain a dead-straight length of copper tube (which should be just sufficient in bore to house these collars), slip the rod through the tube and thread a collar on each end and solder these into either end of the tube, *making sure the rod rotates freely* ; now enlarge the tunnel to take this tube easily, then, with pieces of cotton wool soaked in a red lead and oil mixture, pack the tube so that the rod takes up its correct alignment with the engine *according to the way you ram the packing home*, and then leave to harden. Finally, fill the tube with water pump gland packing grease and install the permanent fitted propeller shaft of *rustless* steel or phosphor-bronze, 5/32 in. diameter. I have not specified any length for the copper tube, as it forms also the main shaft bearings, hence it varies according to the boat ; these glands never seem to leak and have far less friction than the ordinary packed stuffing box.

If possible, make the decks water tight, surrounding the opening for the boiler and engines with a coaming and having the superstructure fitting over this like the lid of a cardboard box ; you can likewise fit the main hatch to get at the lamp ; if this latter is methylated-spirit-fired, fit an extension pipe to its air vent and lead this back to close up to the wick so that any spirit vapour burns in the furnace ; also remember that in a decked-in boat it is almost as important to get the heat out as to let the air in for combustion.

Bilge Ejector

This is a handy fitting, simply consisting of a steam jet let into the horizontal leg of a model T piece, the ejector pipe out the other side, and the suction on the vertical leg ; fit a strainer to this in the bilge by soldering fine gauze over the concave side of a midget tin lid ; it won't work with hot bilge water and you may have to pour cold water into the boat to start it.

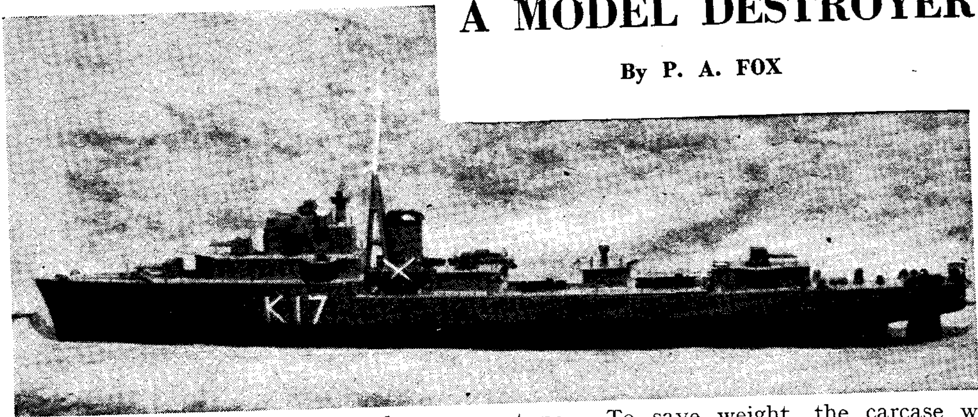
Use single strands of Bowden brake cable for rigging and tauten by looping into short lengths of soft brass wire rove through the holding-down eyebolts and twisting this up ; keep rigging to the minimum and as simple as possible—ratlines are *not always* present !

A word of warning on the subject of scale when building "freelance" ; think what size a member of the crew would be—say you

(*Continued on next page*)

A MODEL DESTROYER

By P. A. FOX



THE model destroyer shown in the reproduced photograph herewith is of the new J, K & L classes. It is 30 in. in length, and is built to a scale of 1/12 in. to 1 ft. For lightness, the hull was carved out of a solid piece of cedar, the decks and deck houses are balsa wood, the funnel and bridge being 2/1,000 in. brass shim stock; all the deck fittings are carved from the remains of a beech plane. Aluminium was used for the guns, as the muzzles are polished. Twin propellers, carried on shafts of 14G. rustless cycle spokes, are coupled by two equal-sized ex-clock wheels. One shaft is carried forward and driven by an electric motor through a 2-1 gear. The propellers and brackets are cut out of aluminium rod. When I built this model I intended to try a rubber-driven motor as used in model planes, except that a train of gears would be used as in a spring motor. I should like to know if a motor of this kind has ever been used in a boat; one advantage is that the rubber could make use of almost the full length of the hull, whereas the spring motor is limited by the width of the hull. However, I decided to try a small electric motor of the usual marine type. To save weight, the carcase was machined from a piece of wrought-iron, $1\frac{1}{8}$ in. diameter, $2\frac{1}{8}$ in. long. The armature is $\frac{3}{4}$ in. diameter, and is laminated, with six poles, and runs on pivot bearings; the commutator is of the disc pattern. This motor runs well on a $4\frac{1}{2}$-volt flashlamp battery, but the brushes require careful adjustment. The propeller shaft inboard bearings are in the end-plate of the motor, the outer end of the shaft is supported by the propeller bracket, so that the stern tubes, which are well above the water line inside the hull, are plain tubes open at both ends. The rigging and railings are fine gauge nickel wire; for stanchions, the smallest pins obtainable were pressed in to the decks and cut off $\frac{1}{4}$ in. high; one wire for the bottom rail is then soldered to the first stanchion and given a few turns round the one at the end of the run. A small pair of pliers with a half round groove filed longways down one jaw are required to press the rail wire against the pins, so forming a half loop on the pin; a touch of solder is then used to secure the wire; the top rail is then soldered along the top of the pins.

A First Model Steam Boat

(*Continued from previous page*)

build round about 1/48 actual, or $\frac{1}{4}$ in. to 1 ft., then a six-foot-tall sailor would be $1\frac{1}{2}$ in. high, which will keep your ideas of superstructures and deck-houses proportionate, and prevent your guard rails from resembling deer fences or the lifeboats wash tubs! Incidentally, remember 1/48 actual would be a pretty large scale, and you cannot reproduce anything much longer than 176 ft. long, and keep the model to a sizable length at the same time in this scale.

The figure for maximum length, given as about 44 in., represents about the largest craft you can get on the floor of the back of a car with four seats.

I would like to add that, as in the bilges of a *steam* working model when running, water and oil are always present, and perhaps traces of fuel, either spirits, petrol, or paraffin, at times, it is problematical if the alternatives to single-piece construction are as robust, especially in the presence of heat and vibration.

The centre of gravity is usually appreciably higher for a steam plant, and the weight distribution not so easy as with an electric motor and accumulators, hence the need for a beamier hull; in two hulls of the same weight (i.e. displacement), if one requires ballast to render it stable, this merely means that most likely extra power will be required to propel it, and it certainly will not be so easy to lift and handle.

Letters

A Satisfactory Belt-fastener

DEAR SIR,—The article by J.A.W. on "Driving Belts," in a recent issue of THE MODEL ENGINEER, interested me very much, as in the past I have had a good deal of trouble with the joints in 5/16 in. round leather belts on a high-speed drilling machine. The high-speed Vee-pulley is only 1¾ in. diameter, and the speed is 1,400 r.p.m., the jumping of the joint and clicking of the fastener were most annoying. A belting merchant suggested making an endless belt by scarfing the ends and cementing them. This proved a great success and the belt has run for years. As it is impossible to feel the joint, there is no trace of jump, and it is perfectly silent. The strength of the cement is amazing, and the man who did it for me said that the leather would go before the joint would.

Yours faithfully,

Reading. S. E. STEVENS.

Testing Pressure Gauges

DEAR SIR,—With reference to the article in the January 22nd issue of THE MODEL ENGINEER on a Pressure Gauge Tester, by Mr. J. P. Stuchfield, the general proportions —area of the ram and weights suggested, are excellent, but I would suggest if oil is used as the pressure medium instead of air, there would be no need to provide a pump, and cup leathers with their attendant friction could be dispensed with.

The layout would consist of :—

A vertical cylinder—bored and lapped, in which works a close-fitting plunger or ram. The upper end of the ram carries a circular plate having a rod in its centre.

The circular weights are placed on this plate and are kept centralised by the rod which passes up through a hole in each weight.

Connected to the bottom of the cylinder is the pipe leading to the gauge to be tested, and controlled by a plug cock. This has a hole drilled through one side of the body and of the plug, thus making it a 3-way cock, by means of which not only can the gauge under test be shut off, but the apparatus can be drained when required.

As it is essential to eliminate all air, the apparatus is charged by removing the ram and pouring in oil till the cylinder is full. The ram is now replaced and the 3-way cock set to the "drain" position. The ram can now be pressed down by hand, causing some oil to escape at the drain ; this is continued until the ram is, say, half an inch from bottoming, when the drain is shut and the apparatus is ready for use.

The gauge to be tested having been connected, the cock is opened, the required weights are placed on the load-plate, which is then given a spin to prove that it is free, and the gauge reading compared with the weights in use.

Additional weights are added, the load-plate spun and the gauge reading noted until all the markings on the gauge have been checked.

As all the air has been eliminated with the exception of that in the gauge itself, and in the connection to it beyond the cock, there is no friction to be overcome, as there is no movement excepting the infinitesimal amount due to the compression and/or release of this trapped air, and this tiny movement only occurs when adding to, or reducing, the weights on the load-plate.

It is as well to provide a means of getting additional oil into the apparatus to make up for any loss which may occur when changing gauges, or from leakage, without having to repeat the original filling process.

One method is to connect an oil cup, provided with a cock, to the bottom of the cylinder. When more oil is required, this cup is filled with oil, the cock opened and the ram lifted by hand, when some of the oil in the cup will be drawn into the cylinder. Never draw out all the oil in the cup or air will inevitably be drawn into the cylinder as well.

Another method is to have a piece of heavy gauge tube—threaded internally—connected to the bottom of the cylinder and having a well-fitting screwed plunger working in it. It facilitates the filling of this attachment if it is arranged to incline upwards from its connection to the cylinder. It is filled by removing the screw plunger—pouring in oil and re-inserting the plunger with the drain open, until the plunger has been screwed in about half way, when the drain is shut and the apparatus is ready for use.

When the load table fails to spin freely, showing that the ram has bottomed and that more oil is required, a turn or two of the screwed plunger will force oil into the cylinder and cause the ram to rise.

The area of the ram and the size of the weights will be dictated by the size of the gauges to be tested. Small gauges which are calibrated in 10 lb. increments can be tested efficiently with a machine having a ram 0.1 sq. in. in area, in which 1 lb., on the load-plate gives 10 lb., per sq. in. on the gauge.

As the most usual fault with a gauge is that the hand is either "fast" or "slow" and requires to be moved, it is as well to provide a small "wheel drawer"—(a tiny horseshoe-shaped gadget with a pointed screw through the centre. The two ends of

the horseshoe engage under the sides of the centre boss of the hand, whilst the screw engages with the end of the spindle of the gauge and thus lifts it off without doing damage)—which can be attached to the machine by a length of fine chain—it will then always be there when it is wanted.

Yours faithfully,

London, S.W. W. BARNARD HART.

Lathe Design

DEAR SIR,—May I beg a little of the valuable space in your columns to comment on certain articles and letters dealing with lathe design which have recently been appearing.

The discussion which has been, and apparently still is, going on has been most interesting, and no doubt certain far-sighted manufacturers are keeping a watchful eye on all this.

Mr. H. H. Ward's suggestions put forward in the issue for January 29th strike some new ground; but one fears that his idea of buying the nucleus of a lathe in (rough?) machined condition and then setting to work to scrape up the bed, fit the mandrel, etc., etc., etc., will not find favour with the majority of people, to whom the lathe is a means to an end and NOT the end itself. I wonder just how many potential model engineers have the requisite skill to do accurately the work Mr. Ward suggests. It is not everyone's job. Industry, incidentally, pays high rates to people who *can* do it.

Further, I fancy that the problem of checking the accuracy of the tool in its various stages of manufacture is not going to prove an easy or cheap one for the amateur, for the dial indicators and test mandrels necessary to carry out such checking properly are apt to be expensive and likely to cost more than the components of the lathe itself.

No, Mr. Ward, taking matters generally I am afraid that attempts to acquire a lathe on these lines could only lead to disappointment. But why should we bother to do all this work anyway; the lathe manufacturers have all the skill, tools and test rigs to ensure that their products are in every way accurate. Moreover, when these facilities are employed over a large number of tools the resultant extra cost to us, the buyers, is not going to be so very much. We had much better pay it, and be certain that not only have we a tool which can be set to work at once, but have also one that is accurate for a start.

Mr. Ward's suggestion for ONE standard lathe I agree with wholeheartedly, there is a lot to be said for it; its adoption would in all probability provide sufficient quantities to permit the further suggestion of the *intelligent* use of plastics to be brought into play. One should remember that the numbers will have to be pretty large or our friend the manufacturer will not think it worth while going to the expense of the dies necessary for the production of plastic components. If satisfactory, there is something rather attractive in the idea of a lathe with dead silent back gear and tumbler gears, but before setting down in our proposed spec. the item "Gears. Moulded or Machined Plastics," it would be well, I feel, to get an expert's view on this matter. I should, however, like to see all hand wheels, knobs and levers (consistant with their mechanical loadings) made up in plastics. The recent icy spell has made me wish for anything but cold cast-iron or steel to hang on to when using the lathe; plastics would tend materially to comfort in operation.

By all means let us make up the lathe accessories from sets of castings. We are on surer ground here. The procedure is a logical one for the amateur, and within the capabilities of both his skill and his equipment. Moreover, such additional gear may be built up as and when required; in this way the call on the pocket will not be so heavy.

Well done, Messrs. Bateman and Wye; your spirited defence of the manufacturer who makes inexpensive lathes was both effective and timely. If it were not for the initiative of such manufacturers the ranks of those model engineers in a position to do machining would be greatly reduced. Of course, the inexpensive lathe is not perfect; if it was, there would be no sale for the higher priced tools. But it represents (or it did represent) first-class value for money. And as to its capabilities? Well, used intelligently, it produces excellent work both as regards accuracy and finish. I know. I've got one, and I would not be without it. What is more, the inexpensive lathe being devoid of frills is admirably suited to the fitting of attachments.

Mr. Harold Eddy, in the issue of January 22nd, raises the question of the accuracy of the markings on both protractors and indices (though why he was apparently using the top slide to do a facing operation I am not quite clear). So far as protractors go I would like to see them left off, as I prefer to do all my angle setting by means of a Starrett No. 183 protractor using the faceplate or chuck face as a reference surface, the protractor blade making contact with the ways of the top-slide. This is, of course, only a personal preference; if, however, protractors are provided, I agree, for

goodness' sake let them be readable and let them be so fitted that they mean something. And these remarks go for indices as well.

The "Spitfire" Tradition

In conclusion, R.V.B., in his reply to "Tubal Caine's" remark that it would be unwise to break away from accepted lathe practice, quotes the modern "Spitfire" aircraft as an example of such a breakaway. Hardly a fortunate choice surely; for of all the examples of *accepted* practice carried to its logical conclusion the Spitfire, I should have thought, must be the classic instance; and I suggest, Sir, that what we want is the Spitfire tradition applied to our ideal lathe design.

Yours faithfully,

East Horsley. IAN BRADLEY.

The Post-War Lathe

DEAR SIR,—The discussion about the post-war lathe in THE MODEL ENGINEER is extremely interesting. I am all for two sizes, a small one to enable high speeds to be obtained for light work—say, about 2½ in. centres—and a good heavy one of 5 in. centres, with different bed lengths. With the bigger one completed, the smaller one could be "made" almost entirely by ourselves.

I cannot remember what previous readers have suggested, and have parted with the issues of THE MODEL ENGINEER concerned, but Mr. Ward seems to have expressed the ideas held by most of my friends. Mr. Tom Senior used to make a business of building lathes up to 5 in. centres, much as Mr. Ward suggests, *i.e.*, planed parts, mandrels bored and reamed, etc., whilst completed headstocks could be purchased, if desired. The prices seemed reasonable to me, and yet Mr. Senior discontinued the production of such lathes. There must have been other firms doing the same thing of whom I do not know. Now, why did Mr. Senior cease doing this? It would appear as if the demand did not exist, or that the vast majority of the MODEL ENGINEER followers preferred to pay around £10 for a complete machine, perhaps not having the necessary confidence in themselves to take on the job of completing the finishing of a lathe from planed parts, etc. Comment on this would be appreciated.

Finally, for myself, no plastic materials, please! (no offence, Mr. Ward). A nicely polished lathe apron, and balanced ball handles are a beauty not to be lost!

Yours faithfully,

St. Helens. A. WHITFIELD.

Clubs

Altrincham Model Power Boat Club

At the annual general meeting held on February 8th, the discussion which followed the presentation of the annual balance-sheet was of production methods for the home workshop. After this, Mr. Waterton gave a demonstration with his 15-c.c. water-cooled engine fitted with the "Aspin" rotary valve. This engine ran very well. Next meeting will be held on Sunday, March 8th, at 2.30 p.m., at this address.

Hon. Sec.: O. B. BATES, 2, Hereford Villas, Hereford Street, Sale.

York and District Society of Model Engineers

The next meeting will be held on March 6th, at 7.30 p.m., at the address below. At the last meeting Mr. Tyson created some amusement by producing an outsize in automatic centre punches, to wit, 11 in. long and ⅞ in. diameter!

Hon. Sec.: H. P. JACKSON (*pro tem.*), 26, Longfield Terrace, York.

The Junior Institution of Engineers

Saturday, 28th February, 1942, at 39, Victoria Street, S.W.1, at 2.30 p.m. Ordinary meeting. Paper, "Producer Gas," by L. Clegg (member).

Carlisle and District Model Engineering Society

We held our annual general meeting on Saturday, January 31st, 1942, and we are all set to carry on another year. We have about fifty members on our books, that is ten more than last year.

We hold a meeting on the last Saturday in every month at 7.0 p.m. in our workshop situate in Abbey Street.

The workshop is open on several nights during the week, and any model-maker who is in the Forces, stationed in the district, will be welcome.

Hon. Sec.: J. V. MILBURN, 51, Marks Avenue, Raffles, Carlisle.

NOTICES.

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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